Table-Top Terawatt Ultra High Field Facility

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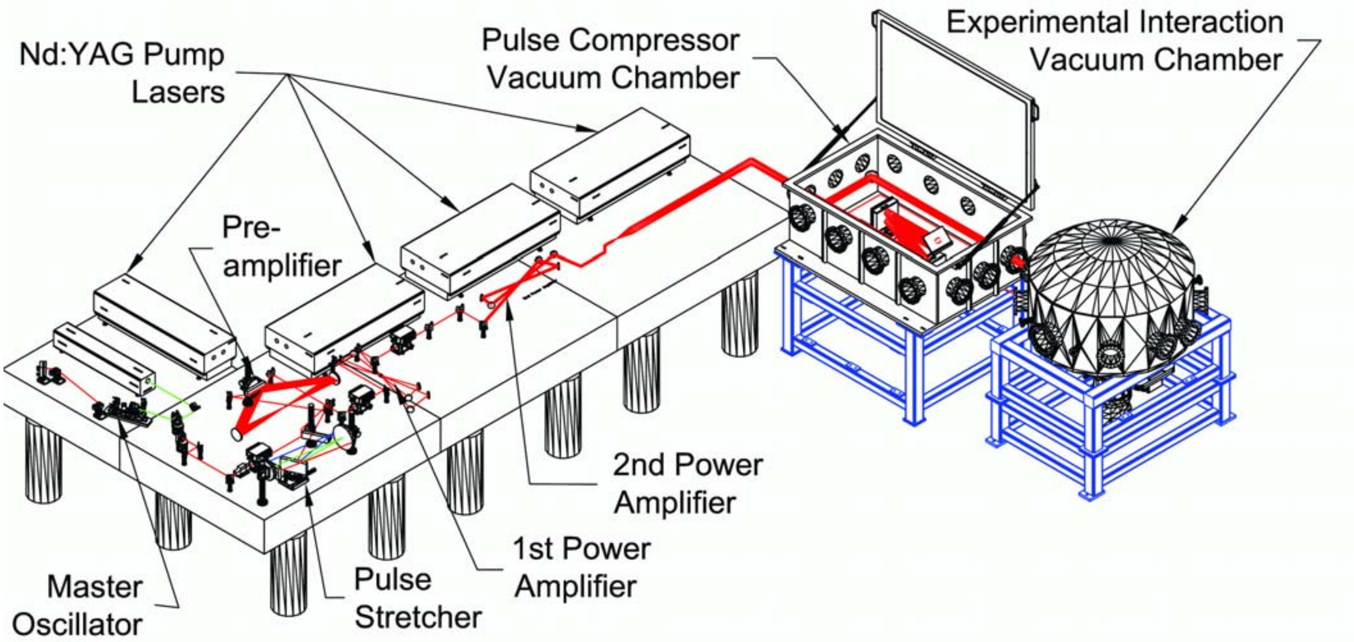

At Argonne National Laboratory a radically new approach to making subpicosecond pulse radiolysis experiments a reality is underway. Our approach is based on pioneering work performed at the University of Michigan where it has been shown that it is possible to generate electron pulses by focussing a femtosecond terawatt (1TW=10^{12} W) laser into a pulsed super sonic gas jet.Because the electron and laser pulses are naturally synchronized jitter is not an issue (in contrast to photocathode based linacs) and the ultimate time resolution that can be obtained in a pulse radiolysis experiment will be dependent only upon the crosscorrelation between the laser and electron pulsewidths.

The Chemistry Division's Table-Top Terawatt Ultrafast High Field Facility (T^3UHFF) is near complete. The purpose of T^3UHFF is to provide a source of femtosecond electron pulses, femtosecond tunable x-rays (soft and hard), and femtosecond proton pulses.T^3UHFF will primarily be used for applications in the fields of chemistry and physics. A Ti:Sapphire based laser system that produces .6J of energy in a 50fs pulse was constructed. This system produces peak powers in excess of 10TW! Because of these extremely high power levels part of the laser system and the experimental areas (target chamber) are contained in vacuum chambers to prevent dielectric beakdown of air. Currently, we are exploring generation of femtosecond pulses of ionizing radiation (both protons and electrons) and of x-rays by focusing this intense beam (power density >10^{19} W/cm^2 !)into either a metal target (hard x-rays and protons) or a supersonic gas jet (energetic electrons).